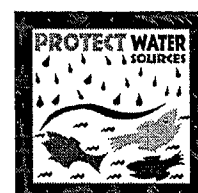


1. Introduction

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1. Introduction

The CALFED Bay-Delta Program (CALFED or Program) is developing a long-term comprehensive plan to restore the ecological health and improve water management for beneficial uses of the Bay-Delta system.

The CALFED Bay-Delta Program has made an affirmative commitment to implement a robust, incentive-based Water Use Efficiency Program which will assure that water will be used efficiently in the CALFED Solution Area. The Water Use Efficiency approach integrates State legal requirements and the practical need for local implementation through a combination of technical assistance, incentives, and directed studies for the four WUE program elements: Agricultural, Urban, Water Recycling, and Managed Refuges.

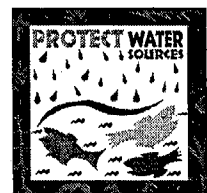
Although details of these elements are currently being refined, implementation is scheduled to begin during 2000. Technical Assistance Programs and directed studies will begin for all four elements in 2000. Partial implementation of the agricultural incentive program will also begin in 2000. The remaining incentive programs will soon follow. Incentive programs will be designed to award CALFED grant funding for projects that demonstrate potential to provide CALFED water supply reliability, water quality, or ecosystem restoration benefits.

The agricultural and urban elements have unique assurance mechanisms. Assurance of high agricultural water use efficiency will be based on a set of agricultural Water Use Efficiency quantifiable objectives. The quantifiable objectives are currently being developed, and will include targeted benefits, measurable indicators, and regional implementation strategies. These quantifiable objectives will be drafted by January 2000 and some of them will be ready for early implementation by the Record of Decision.

Assurance of high urban water use efficiency will be based on a certification process that will provide a rigorous peer review of urban implementation of established Best Management Practices. The certification process is currently being drafted, and will be ready by the Record of Decision.

For the purpose of developing and implementing a Water Use Efficiency Program, CALFED's definition of **efficient water use is the implementation of local water management actions that increase the achievement of CALFED goals and objectives.** This definition encompasses improvements in water timing, quality, and in-stream flows and is therefore broader than traditional definitions of physical efficiency.

The Water Use Efficiency Program will help ensure that California's water supplies are used efficiently and result in multiple benefits. The Program focuses on improvements in local water use management and efficiency in the urban, agricultural, and managed wetlands water use sectors.



This technical document discusses the efforts, estimates, and assumptions of CALFED staff, often working closely with stakeholder interests, in the following areas:

- Development of an implementable water use efficiency component to include:
 - agricultural water use efficiency
 - urban water conservation
 - urban water recycling
 - effective use of managed wetlands water
- Estimation of potential agricultural and urban water savings as a result of implementing the water use efficiency program policies.
- Estimation of potential urban water recycling.

This technical document is organized in sections that correspond to the items outlined above. A summary of potential water savings resulting from urban and agricultural water use efficiency improvements is presented at the end of this section.

1.1 PUBLIC POLICY FOUNDATIONS

California public policy places a strong emphasis on efficient use of developed water supplies. The California Constitution (Article X, Section 2) prohibits “waste or unreasonable use” of water and excludes from water rights any water that is not reasonably required for beneficial use. The constitutional prohibitions of waste and unreasonable use are repeated in Sections 100 and 101 of the California Water Code. The state’s process for appropriation of water rights also is based on furtherance of the constitutional policy of reasonable and beneficial use (Cal. Water Code Section 1050). The State Water Resources Control Board (SWRCB) can and does place water conservation conditions on water rights permits that it approves.

California public policy places a strong emphasis on efficient use of developed water supplies and on water recycling. State and federal water projects also are affected by efficiency requirements.

The California Water Code requires all urban water suppliers to prepare and adopt urban water management plans, and requires first consideration be given to demand management measures that offer lower incremental costs than expanded or additional water supplies (Cal. Water Code Section 10610 *et seq.*) The Water Code previously placed planning requirements on agricultural water suppliers, but these provisions have expired as a result of sunset provisions (Cal. Water Code Section 10800 *et seq.*)

State and federal water projects also are affected by efficiency requirements. The Central Valley Project Improvement Act (CVPIA) calls for the development of water conservation criteria “with the purpose of promoting the highest level of water use efficiency reasonably achievable by project contractors.” Some State Water Project (SWP) contracts contain conservation requirements, and some water right permits granted to the SWP by the SWRCB contain specific conservation requirements.

Efforts by the SWRCB to place more specific efficiency conditions on water right permits also have led to innovative voluntary efforts. Proposed efficiency requirements in the SWRCB's draft 1988 Water Quality Control Plan (WQCP) for the Bay-Delta prompted efforts that ultimately resulted in the creation of the California Urban Water Conservation Council (CUWCC) and implementation of urban best management practices (BMPs) by many urban agencies. The draft WQCP also prompted the negotiation of the Memorandum of Understanding Regarding Efficient Water Management Practices by Agricultural Water Suppliers in California (Agricultural MOU).

California public policy also places a strong emphasis on water recycling. California Water Code Section 461 provides that the public policy of the State requires the maximum re-use of wastewater. California Water Reclamation Law (Cal. Water Code Sections 13500-13556) declares that the people of California have a primary interest in developing water reclamation facilities to meet the State's reliable water needs, and augment existing surface water and groundwater resources. California Water Code Section 13512 declares the intent of the Legislature and the State to undertake steps to encourage development of water reclamation facilities and beneficial reuse of reclaimed water. The Water Recycling Act of 1991 (Cal. Water Code Section 13577) set recycling goals of 700,000 acre-feet (700 TAF) of water annually by 2000 and 1 million acre-feet (MAF) annually by 2010.

Further legislative and regulatory provisions reiterate the general tenets of California Water Reclamation Law, specifically focusing on coastal areas. In coastal zone areas, recycling of treated water that otherwise would have been disposed into the ocean, creates a "new" supply of water for that region. This is recognized legislatively in California Water Code Section 13142.5(e), which urges wastewater treatment agencies located in a coastal zone to reclaim and re-use as much of their treated effluent as is practicable. It is also recognized through regulation by the SWRCB in its 1984 decision "in the matter of the Sierra Club, San Diego Chapter," Order No. WQ 84-7, where the Board held as follows:

In coastal zone areas, recycling of treated water that otherwise would have been disposed into the ocean, creates a "new" supply of water for that region.

In this case and all other cases where an applicant proposes to discharge effluent once-used wastewater into the ocean, the report of the discharge should include an explanation of why the effluent is not being reclaimed for further beneficial uses.

This is consistent with State policy established by the Legislature in California Water Code Section 13142.5(e).

1.2 WATER USE EFFICIENCY IN THE BAY-DELTA SYSTEM TODAY

California's strong public policy emphasis on efficiency and conservation ethic is reflected in many outstanding water use efficiency and conservation efforts throughout the state. California irrigation districts and growers have implemented pioneering methods to manage water supplies and improve efficiency. These methods include automated canal control, flexible water deliveries, new irrigation system technology, drainage reduction techniques, and computerized crop water information. Similarly, urban water suppliers have worked with public interest groups to create the CUWCC, a nationally recognized forum for the successful advancement of understanding and implementation of urban water use efficiency measures.

California irrigation districts and growers have implemented pioneering methods to manage water supplies and improve efficiency.

Two steps can be taken to increase water use efficiency:

1. CALFED agencies must encourage more water users and water suppliers to implement efficient water management practices (EWMPs) that are locally cost effective. Many methods are being used successfully throughout the state to obtain maximum benefits from our water supplies while also providing an economic return for those investing in these technologies.

However, implementation of locally cost-effective measures have either not been implemented or documented sufficiently. Less than half of California's population is served by urban water retailers that are members of the CUWCC, and slightly more than one-third of the state's agricultural lands are served by irrigation districts that are members of the corresponding AWMC.

2. CALFED will provide funding to tip the local economic scales and foster implementation of practices that are cost effective from a state-wide perspective. Such practices are not cost effective locally (do not provide the water user or district with a return on their efficiency investment) but would provide benefits to the state as a whole that are greater than their cost.

CALFED will provide funding to tip the local economic scales and foster implementation of practices that are cost effective from a state-wide perspective.

CALFED will accomplish these two steps through a series of actions, most notably including agricultural and urban conservation incentive programs that will provide technical assistance and financing to aid adoption of locally cost-effective measures, and grants to foster implementation of measures that are cost effective from a state-wide perspective.

1.3 BASIS FOR A CALFED WATER USE EFFICIENCY PROGRAM

CALFED is addressing problems related to ecosystem health, water quality, water supply reliability, and levee system integrity. The water use efficiency component can contribute to solution of problems in several of these categories. Clearly, water use efficiency can help to achieve the Program's goal for water supply reliability—reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system. In addition, changes in local water management, compatible with intended beneficial uses, can help achieve other objectives of the Program, such as improving water quality, reducing diversion effects on fisheries, and benefitting in-stream flows.

During April and May in 1996, a series of public meetings and workshops were held to explain the CALFED Program alternatives under consideration at that time and solicit comments from the public about these alternatives. Citizens from all parts of the state expressed strong support for water use efficiency. There is a strong sentiment that water use efficiency should figure prominently in the CALFED Program and that existing supplies be used efficiently before new storage or improved cross-Delta conveyance are developed. The CALFED Program recognizes and agrees with this view, and believes the Water Use Efficiency Program has been developed to optimize the implementation of feasible and effective efficiency measures.

There is a strong sentiment that water use efficiency should figure prominently in the CALFED Program and that existing supplies be used efficiently before new storage or improved

1.4 SUMMARY OF POTENTIAL WATER CONSERVATION AND RECYCLING

Water use efficiency measures can make additional water supplies available for environmental or consumptive uses and can serve as a useful tool for addressing many of the problems in watershed management. Improvements in water use efficiency are anticipated from a wide range of CALFED programs, not all of which are reflected in this discussion of the Water Use Efficiency Program. As with other program elements, actions and activities undertaken throughout the CALFED Program can result in corollary benefits in other CALFED program areas. For example, CALFED expects to generate water use efficiency incentives through improvements in the water market and through willing-seller water acquisitions for the Ecosystem Restoration Program to augment in-stream flows. In addition, improvements in water quality in the Water Quality Program can assist in meeting water use efficiency goals, by reducing the need for water to meet soil leaching requirements and by enhancing water reclamation opportunities. Similarly, actions taken under the Water Use Efficiency Program are expected to result in ancillary benefits for other CALFED objectives. Reducing unnecessary surface runoff from farms and urban areas can enhance water quality by reducing the discharge of unwanted substances into watercourses. In addition, water use efficiency measures can improve water supply reliability by increasing the number of opportunities available to water managers. Finally, through the planning and implementation of water use efficiency measures, the cost effectiveness of various storage components will become better defined.

Water use efficiency measures can make additional water supplies available for environmental or consumptive uses.

Based on the analyses detailed in Sections 4, 5, and 6 of this document, estimates of potential reduction of water application and losses are summarized in Tables 1-1, 1-2, 1-3, and 1-4. Values provided in the following summary tables represent potential reductions of water application and irrecoverable losses that are most likely to occur for future conditions regardless of the outcome of a CALFED solution (termed the No Action Alternative), as well as the potential incremental savings from a CALFED solution. Representative values shown in this summary table are all midpoints from the ranges detailed in Sections 4, 5, and 6.

The purpose of these tables is to give a perspective of the order of magnitude of the potential effects of water use efficiency improvements both with and without the CALFED solution. **The values presented are not goals or targets.** Rather, they are intended to provide the relative magnitude of potential results of efficiency actions. Actual savings will depend on the magnitude of State, Federal and local investment in water use efficiency measures. Stakeholders disagree on the magnitude and/or the feasibility of achieving these values. Stakeholders do agree, however, that water conservation can provide significant benefits for multiple purposes and therefore is a significant contribution to the CALFED solution. Consistent with a programmatic analysis, specific actions or programs that would need to be implemented to achieve these results have not been specified.

The tables describe three types of potential reductions:

- ***Recovered losses with potential for rerouting flows*** - These losses currently return to the water system, either as groundwater recharge, river accretion, or direct reuse. Reduction in these losses would not increase the overall volume of water but might result in other benefits, such as making water available for irrigation or in-stream flows during dry periods, improving water quality, decreasing diversion impacts, or improving flow between the point of diversion and the point of reentry.
- ***Potential for recovering currently irrecoverable losses*** - These losses currently flow to a salt sink, inaccessible or degraded aquifer, or the atmosphere and are unavailable for reuse. Reduction in these losses would increase the volume of useable water.
- ***Potential reduction of application*** - This is the sum of the previous reductions.

Recovering water that is "lost" to a salt sink, inaccessible or degraded aquifer, or the atmosphere would increase the volume of useable water.

Tables 1-2, 1-3, and 1-4 present more detailed summaries of conservation savings as developed in Sections 4, 5, and 6. Significant local, regional, state, and federal support will be necessary to achieve the expected results.

Table 1-1. Summary of Estimated Conservation and Recycling Potential (TAF)

USE	NO ACTION ALTERNATIVE ¹ (IN ABSENCE OF CALFED)			POTENTIAL CALFED INCREMENT			TOTAL CONSERVATION POTENTIAL		
	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS (A=C-B)	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES (B)	TOTAL POTENTIAL REDUCTION OF APPLICATION (C)	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS (A=C-B)	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES (B)	TOTAL POTENTIAL REDUCTION OF APPLICATION (C)	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS (A=C-B)	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES (B)	TOTAL POTENTIAL REDUCTION OF APPLICATION (C)
Urban	397	530	927	355	680	1,035	752	1,210	1,962
Agricultural	2,235	220	2,457	1,676	165	1,841	3,911	385	4,299
Urban recycling	<u>55</u>	<u>455</u>	<u>510</u>	<u>188</u>	<u>567</u>	<u>755</u>	<u>243</u>	<u>1,022</u>	<u>1,265</u>
Total	2,687	1,205	3,894	2,219	1,412	3,631	4,906	2,617	7,526

Note:

Representative values shown are all midpoints in value ranges shown in Tables 1-2, 1-3, and 1-4. See Sections 4, 5, and 6.

¹ No Action Alternative recycling values do not include the existing recycling level of 485 TAF (the March 1998 Water Use Efficiency Technical Appendix inadvertently included the existing values):

Table 1-2. Summary of Potential Agricultural Water Conservation (TAF)

REGION	NO ACTION ALTERNATIVE (IN ABSENCE OF CALFED)			CALFED INCREMENT (RESULT OF CALFED ACTIONS)			TOTAL CONSERVATION POTENTIAL		
	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES	TOTAL POTENTIAL REDUCTION OF APPLICATION	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES	TOTAL POTENTIAL REDUCTION OF APPLICATION	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES	TOTAL POTENTIAL REDUCTION OF APPLICATION
Sacramento	766-783	0-36	766-819	574-587	0-27	574-614	1,340-1,370	0-63	1,340-1,434
Delta	124-134	0	125-134	93-100	0	93-100	217-234	0	217-234
Westside San Joaquin River	124-128	0-9	124-137	93-96	0-7	93-103	217-224	0-16	217-241
Eastside San Joaquin River	436-463	0-7	436-471	327-347	0-6	327-353	763-810	0-13	764-824
Tulare Lake	685	23-110	708-795	514	17-82	531-596	1,199	40-192	1,239-1,391
San Francisco Bay	4	2-3	7-8	3	2-3	5-6	7	4-6	12-14
Central Coast	3-4	0	3-4	2-3	0	2-3	5-7	0	5-7
South Coast	36	20-31	56-67	27	15-23	42-50	63	35-54	97-117
Colorado River	28	73-126	101-154	21	54-95	75-116	49	127-221	176-270
Total	2,206-2,265	118-322	2,326-2,589	1,654-1,698	88-243	1,742-1,941	3,860-3,963	206-565	4,067-4,532
Mid-Point	2,235	220	2,457	1,676	165	1,841	3,911	385	4,299

Note:

See Section 4 for information on the development of these values.

Table 1-3. Summary of Potential Urban Water Conservation (TAF)

REGION	NO ACTION ALTERNATIVE (IN ABSENCE OF CALFED)			CALFED INCREMENT (RESULT OF CALFED ACTIONS)			TOTAL CONSERVATION POTENTIAL		
	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS (A=C-B)	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES (B)	TOTAL POTENTIAL REDUCTION OF APPLICATION (C)	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS (A=C-B)	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES (B)	TOTAL POTENTIAL REDUCTION OF APPLICATION (C)	RECOVERED LOSSES WITH POTENTIAL FOR REROUTING FLOWS (A=C-B)	POTENTIAL FOR RECOVERING CURRENTLY IRRECOVERABLE LOSSES (B)	TOTAL POTENTIAL REDUCTION OF APPLICATION (C)
Sacramento	140-156	5-9	145-165	81-96	4-9	85-105	221-272	9-18	230-270
Eastside San Joaquin River	87-103	3-7	90-110	89-104	6-11	95-115	176-207	9-18	185-225
Tulare Lake	40-45	15-30	55-75	50-55	30-45	80-100	90-100	45-75	135-175
San Francisco Bay	10	65-80	75-90	10	120-140	130-150	20	185-220	205-240
Central Coast	0	20-40	20-40	0	30-50	30-50	0	50-90	50-90
South Coast	70-75	340-385	410-460	75-80	400-445	480-520	150	740-830	890-980
Colorado River	30	20-40	50-70	30	25-45	55-75	60-70	45-85	105-145
Total	375-420	470-590	845-1,010	335-375	615-745	955-1,115	715-790	1,085-1,335	1,800-2,125
Mid-Point	397	530	927	355	680	1,035	752	1,210	1,962

Note:

See Section 5 for information on the development of these values.

Table 1-4. Summary of Potential Urban Water Recycling (TAF)

REGION	NO ACTION ALTERNATIVE ¹ (IN ABSENCE OF CALFED)		CALFED INCREMENT (RESULT OF CALFED ACTIONS)		TOTAL CONSERVATION POTENTIAL	
	CONSERVATION POTENTIAL	IRRECOVERABLE LOSS SAVINGS	CONSERVATION POTENTIAL	IRRECOVERABLE LOSS SAVINGS	CONSERVATION POTENTIAL	IRRECOVERABLE LOSS SAVINGS
San Francisco Bay	53	48	50-170	40-130	103-223	88-178
Central Coast	35	33	30-70	20-50	65-105	53-83
South Coast	<u>392</u>	<u>349</u>	<u>350-810</u>	<u>260-610</u>	<u>742-1,202</u>	<u>609-959</u>
Total	510 ¹	455 ¹	460-1,050	345-790	970-1,560 ¹	800-1,245 ¹
Mid-Point			755	567	1,265	1,022

Note:

See Section 6 for information on the development of these values.

These values do not include the existing 485 TAF of water recycling (the March 1998 Water Use Efficiency Technical Appendix inadvertently included the existing values).

¹ The three hydrologic values do not add up to the total because of recycling that is expected to occur in other regions (see Table 6-2)

1.5 VARIATION IN CONSERVATION ESTIMATES

The estimates of conservation potential contained in this document are not the only estimates issued by CALFED agencies. In November 1998, DWR released the California Water Plan, Bulletin 160-98. The public review draft, published in January 1998, received substantial review. The final report reflects comments from reviewers as well as refinements made by DWR. Bulletin 160 presents DWR's estimates of reductions in water demand (depletion reductions) that may occur from the implementation of various demand management measures, including urban and agricultural water conservation and urban water recycling. The estimates prepared by DWR and CALFED will not be identical, because they are prepared for different planning purposes and they examine different scenarios of the future.

The Bulletin 160 series is a framework document designed to assist with water resources decisions. Baseline estimates of future conservation savings are prudently conservative so that the future gap between supply and demand is not underestimated. Additional options for potential future conservation savings, which may be more difficult to achieve, also are presented.

For purposes of comparison to CALFED's conservation estimates, Table 1-5 presents conservation and recycling estimates published in DWR's Bulletin 160-98. **The Bulletin 160-98 options (right-hand set of columns) are comparable to CALFED's No Action Alternative conservation estimates.**

As can be seen in Table 1-5, the Bulletin 160-98 depletion reduction estimates are similar to the CALFED No Action Alternative irrecoverable loss savings (under CALFED's definition, depletion reductions are the same as currently irrecoverable loss reductions). For instance, anticipated agricultural conservation savings estimated by CALFED are between 132 and 324 TAF. Bulletin 160-98's option estimates this savings at 230 TAF.

Table 1-5. Summary of DWR's Bulletin 160-98 Projected Depletion Reductions (TAF)

USE	DWR ASSUMED BASELINE CONSERVATION SAVINGS ¹		BULLETIN 160-98 IMPLEMENTED OPTIONS ²	
	CONSERVATION POTENTIAL	IRRECOVERABLE LOSS SAVINGS	CONSERVATION POTENTIAL	IRRECOVERABLE LOSS SAVINGS
Urban	1,514	868	n/a	930
Agricultural	797	233	n/a	230
Urban recycling	<u>577³</u>	<u>407³</u>	<u>835</u>	<u>655</u>
Total	2,888	1,508	n/a	1,815

Note: Values are from DWR's November 1998 California Water Plan, Bulletin 160-98.

¹ These savings are anticipated to occur by 2020 as a result of implementing urban best management practices and agricultural EWMPs.

² These values represent various urban and agricultural options that could be implemented to improve water use beyond levels expected in the baseline. The values are comparable to the CALFED No Action Alternative estimate but contain savings in regions outside the CALFED geographic scope and overlap with some of the urban conservation actions expected by CALFED to occur as a result of CALFED actions, not only No Action Alternative conditions (this is discussed in more detail in the main text).

³ The bulletin's "base" is lower than that assumed for CALFED (see Section 6).

The CALFED conservation estimates do vary from those of the bulletin because of three factors:

- The bulletin value includes areas outside the CALFED geographic scope, such as the North Coast and North Lahontan Regions.
- The Bulletin value includes options that overlap with measures assumed by CALFED not to occur under the No Action Alternative (such as greater landscape savings and lower indoor per-capita water use rates).
- CALFED's No Action Alternative recycling values include a portion of the baseline recycling anticipated to occur between now and 2020 as a result of the "build out" of existing recycling facilities. (The Bulletin considers all recycling expected by 2020 in the baseline— this includes 90 TAF of recycling projects that have yet to be brought into full production as existing projects continue to ramp up their recycled water production.)

As an example of overlap conditions, CALFED assumes that CII savings assumed by the bulletin are actually split between being implemented under No Action Alternative conditions and as a result of CALFED actions. Additionally, CALFED assumes indoor residential water use to reach only 60 gallons per capita daily (gpcd) under the No Action Alternative condition, whereas Bulletin 160-98 options assumes that this amount could drop to 55 gpcd. Again, CALFED assumes that this lower use rate occurs only as a result of the CALFED Program. When adjustments are made for the overlaps, the bulletin's estimates of conservation potential more closely match the CALFED No Action Alternative conditions.

When adjusting CALFED's No Action Alternative water recycling estimate for inclusion of the portion of the "base" water recycling yet to occur, the CALFED and Bulletin 160-98 levels compare favorably. (CALFED's estimate is 130 TAF higher than the bulletin's option—approximately the amount included in the bulletin's baseline value that is not existing).

The CALFED Program further anticipates conservation and recycling savings to increase beyond the estimates discussed in Bulletin 160-98 as a result of the CALFED Program. This is illustrated when the **option** values in Table 1-5 are compared to the **totals** in Table 1-1. CALFED has assumed that more than 1.4 MAF of additional reduction in irrecoverable losses, beyond the No Action Alternative conditions, could occur as a result of a successful CALFED Bay-Delta solution.